COMPARING METHODS FOR CLASSIFYING 'DANGEROUS HEAT' IN HEAT HEALTH WARNING SYSTEMS

Kai Zhang, *School of Public Health, University of Michigan, Ann Arbor, MI USA*
Richard B. Rood, *College of Engineering, University of Michigan, Ann Arbor, MI USA*
George Michailidis, *Department of Statistics, University of Michigan, Ann Arbor, MI USA*
Evan M. Oswald, *College of Engineering, University of Michigan, Ann Arbor, MI USA*
Marie S. O'Neill, *School of Public Health, University of Michigan, Ann Arbor, MI USA*
Joel D. Schwartz, *Department of Environmental Health, Harvard University, MA.USA*
Antonella Zanobetti, *Department of Environmental Health, Harvard University, MA.USA*
Kristie L. Ebi, *Stanford University, Palo Alto, CA, USA.*

Background and Aims: Heat waves have been linked to excess mortality and morbidity, and are projected to increase in frequency and intensity with a warming climate. Several proposed weather-related triggers for activating heat health warning system (HHWS) triggers exist, including simple temperature or heat index (HI) thresholds and the synoptic (air mass) approach. This study compares methods to trigger HHWS, and introduces a new flexible data-driven method that combines the air mass approach with a more transparent procedure.

Methods: A novel multi-level hybrid clustering method (HCM) was developed to identify extremely hot days. The number of levels subjects to users' demand. Two-level and three-level HCM as well as common indices, including spatial synoptic classification (SSC), 90^{th}, 95^{th} and 99^{th} percentile minimum heat index (HI) methods lasting for at least two days, were calculated using a historical summer time (May 1st to September 30th) weather dataset in Detroit from 1976 to 2006.

Results: The HCM, SSC, and minimum heat index methods differed greatly. The 90^{th} minimum HI tended to define more potentially dangerously hot days (405 days over 31 years) than SSC (355 days), two-level HCM (189 days), three-level HCM (69 days), 95th and 99th minimum HI (180 and 22 days). SSC tended to include the days with lower daily minimum temperature and dew point. The average minimum temperature and dew point of SSC-identified heat wave days were 2.6 and 5.3 ^{o}C lower compared to those days identified by other methods. The overlapping days between SSC and other methods were small or moderate, ranging from 21 to 151 days.

Conclusions: Our proposed clustering framework shows some advantages such as flexibility and relatively transparency compared to the current synoptic classification methods. It can be applied in HHWSs, epidemiological studies and public health interventions to protect vulnerable populations from extreme heat events.